

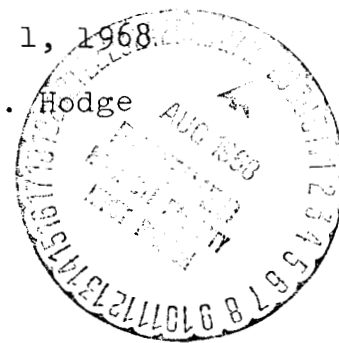
BELLCOMM. INC.

1100 Seventeenth Street, N.W. Washington, D. C. 20036

SUBJECT: Mission "D" Extravehicular Activity -
Case 370

DATE: July 1, 1968

FROM: W. H. Hodge



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ABSTRACT

This memorandum provides familiarization with the orbital extravehicular activity plans for Apollo. The current status of objectives, procedures, and hardware provisions are outlined.

The only orbital extravehicular activity planned for Apollo will occur on the fourth day of Mission D for the purpose of demonstrating extravehicular transfer from the Lunar Module to the Command Module. This demonstration will precede any manned separation of the LM from the CSM.

The transfer will be along a series of handrails which are permanently attached to the exterior of the CM and the LM. During the activity, the extravehicular crewman will be tethered by a 25 foot line to a point in the LM interior.

The activity will also include evaluation of the spacecraft exterior lighting aids, retrieving of several thermal samples from their mountings on the spacecraft exteriors, and evaluation of the Portable Life Support System which will provide life support for the extravehicular crewman.

The other two crewmen - one in the CM and the other in the LM - will actively support the approximately two-hour long extravehicular activity period. They will perform system maintenance, stow the retrieved thermal samples, and operate the sequence cameras which will record much of the activity from both the CM and the LM.

In response to the feeling by Dr. Low that the EVA should be simplified, it was decided at a recent CCB meeting at MSC to reduce the number of transfers (LM to CM and return) from two to one.

The Extravehicular Activity Task Force at MSC continues to coordinate the planning, training, and other preparation for this orbital extravehicular activity. Of current concern to the preparation are thermal constraints on CM and LM hatch-open time and exposure of the CM Pilot's Intravehicular Suit to the extravehicular environment while the CM hatch is open.

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ACTIVITY (Bellcomm, Inc.) 5 P

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BELLCOMM, INC.

1100 Seventeenth Street, N.W. Washington, D. C. 20036

SUBJECT: Mission "D" Extravehicular Activity -
Case 320

DATE: July 1, 1968

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MEMORANDUM FOR FILE

INTRODUCTION

This memorandum outlines the planned orbital extravehicular activity on Apollo, the objectives of that activity, and the hardware that will be used to accomplish those objectives. The purpose of this memorandum is to familiarize people with the scope and nature of Apollo orbital extravehicular activity. It is emphasized that this report represents current status rather than the final word.

The only earth orbital extravehicular activity planned for Apollo will take place on the fourth day of Mission D - the first mission involving manned LM operations. The purpose is to demonstrate the capability to perform an extravehicular transfer from the Lunar Module to the Command Module when they are docked. This demonstration is considered necessary to show that the LM crew will have a means of getting back into the CM in case of inability to get back through the tunnel. Demonstration of this capability will precede any manned separation of the LM from the CSM.

TRANSFER PATH

The transfer path between the LM and the CSM (Fig. 1) is formed by a series of fixed handrails on the LM and the CM. The extravehicular crewman maneuvers hand-over-hand along the handrails on the surface of the spacecraft. The handrails have been sized for adequate glove clearance without producing excessive protuberances on the heat shield surface. The ends of the rails on the CM and the LM have been sloped to avoid snagging either the extravehicular crewman's suit or the parachute risers. Tests have been run to make sure that the handrails do not interfere with the chute risers if they sweep across the CM surface.* The flight testing of several handrails on S/C 017 and 020 revealed no problems. Post-flight examination revealed no degradation of the surrounding heat shield surface, and the handrails were still in very good condition.

*The tests revealed no chute riser problems, but did show a weakness in the handrail attachment to the CM. After beef-up of this attachment, the riser sweep tests will be performed again.

TETHERS

The handrails also serve as attach points for restraint tethers. The extravehicular crewman will employ three major tethers - a long (approximately 25 feet) "life-line" attached to a point in the LM interior and two short personal restraint tethers which can be attached to the handrail attach points. The short personal restraint tethers will be used for local area restraint as required.

LIGHTING AIDS

Several lighting aids on the spacecraft exterior are available to the extravehicular crewman. The docking spotlight, the EVA pole-light, and radioluminescent discs imbedded in the handrails all offer lighting that can be used during EVA. Various combinations of lighting will be evaluated on Mission D.

LIFE SUPPORT

Life support for the extravehicular crewman during the Mission D EVA will be provided by the Portable Life Support System. Emergency oxygen will be available from the Oxygen Purge System which will be mounted on top of the PLSS. This extravehicular use of the PLSS will be the only such activity prior to its use on the lunar surface. Both its ability to remove metabolic heat and its communications capability will be exercised and evaluated on this EVA.

PLANNED OPERATIONS

The Mission D EVA will be performed by one crewman but with active support from the other two crew members (one located in the CM and the other in the LM). The following is an outline of the extravehicular crewman's planned activities:

1. Transfer from the LM to the CM and ingress;
2. Egress CM, gather the CSM thermal samples and pass them to the CM Pilot;
3. Transfer back to the LM and secure to the LM porch to wait for a dark-side pass;
4. Perform a communications mode check-out while dark-adapting;
5. Evaluate various combinations of exterior lighting during the dark-side pass;

6. Retrieve LM thermal sample and pass to the Commander inside the LM;

7. Remain restrained on the LM porch during a portion of the second daylight pass; this provides an opportunity to make still photos and use the already available TV;

8. Ingress LM.

This outline reflects a recent CCB decision (May 24) to reduce the number of transfers from CM to LM and return from two to one. Dr. Low had requested a simplification of the EVA.

Throughout this exercise, the crewmen in the CM and LM have been busy with communications checks, system maintenance, thermal sample stowage, and camera operation. Two sequence cameras - one at each end of the transfer path - will film the initial LM to CM transfer. The time from initial egress to final ingress may take up to two hours.

CURRENT ACTIVITIES

Most of the planning and coordination for the Mission D EVA has been conducted by the EVA Task Force at MSC.* Items that are currently of concern to the group include:

1. Thermal considerations may constrain the length of time that the CM and LM hatches can remain open leaving the spacecraft interiors exposed to direct sunlight and/or deep space. Grumman is maintaining a 20 minute limitation on hatch-open time; North American-Rockwell is maintaining a 20 minute deep space exposure limitation and one hour sunlight exposure limitation. It would be desirable to leave the hatches open for a much longer time - up to two hours - during the EVA.

2. Exposure to the extravehicular environment of the CM Pilot's Intravehicular Suit may have an adverse affect on that suit. When the CM hatch is open, the CM Pilot - who is wearing the Intravehicular Suit required for shoulder clearance with the new couches - will be exposed to deep space and direct sunlight. The capability of the IV Suit to withstand this environment is being studied by MSC/Crew Systems Division.

In addition to this activity, training and equipment development work is being carried out in both KC-135 zero-g aircraft and MSC's Water Immersion Facility. Handrail location,

*This group was formed in late 1966 and has met approximately once every six weeks since that time. Led by MSC/ASPO, the group has representatives from several MSC organizations and Headquarters. The author has attended most of the meetings during the past year.

crewman/antenna clearance, and other items have been checked-out in these tests to date. Camera locations and tether configurations are currently being evaluated.

SUMMARY

The only orbital extravehicular activity planned for Apollo will occur on Mission D for the purpose of demonstrating extravehicular transfer from the Lunar Module to the Command Module. This demonstration will precede any manned separation of the LM from the CSM. In addition to the transfer demonstration, thermal samples will be retrieved from the spacecraft exterior, the exterior lighting aids will be evaluated, and the Portable Life Support System will be evaluated in its only extravehicular use prior to the lunar landing.

Planning, training, and hardware design are progressing steadily. This preparatory activity is being coordinated by the Extravehicular Activity Task Force at MSC.

W. H. Hodge
W. H. Hodge

2031-WHH-cjz

Attachment (a/s)

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LM-CSM EVA TRANSFER PATH (DOCKED)

